

Claims

1. A fuel cell, comprising:

an anode support plate and a cathode support plate and a
membrane electrode assembly disposed between said anode and
5 cathode support plates, said membrane electrode assembly
comprising a polymer electrolyte membrane, at least one of said
support plates comprising a hydrophilic substrate layer having pores
therein;

10 a water transport plate adjacent to each said hydrophilic
substrate layer, each said water transport plate having a passageway
for a water stream and another passageway for a reactant gas
stream; and

15 a partially hydrophobic porous carbon fluoropolymer particulate
composite diffusion layer disposed between at least one said
hydrophilic substrate layer and said membrane electrode assembly,
each said diffusion layer comprising about 10% fluoropolymer by
weight.

2. A fuel cell according to claim 1 wherein:

said diffusion layer comprises a fluoropolymer selected from
the group consisting of polytetrafluoroethylene, fluorinated ethylene
propylene, polytetrafluoroethylene-co-perfluoromethyl vinylether,
5 copolymers of ethylene and tetrafluoroethylene, copolymers of
ethylene and chlorotrifluoroethylene, polyvinylidene fluoride, polyvinyl
fluoride and amorphous fluoropolymers.

3. A fuel cell, comprising: ~

an anode support plate and a cathode support plate and a membrane electrode assembly disposed between said anode and cathode support plates, said membrane electrode assembly
5 comprising a polymer electrolyte membrane, at least one of said support plates comprising a hydrophilic substrate layer having pores therein;

a water transport plate adjacent to each said hydrophilic substrate layer, each said water transport plate having a passageway
10 for a water stream and another passageway for a reactant gas stream; and

a diffusion layer disposed between at least one said hydrophilic substrate layer and said membrane electrode assembly, the thickness of each said diffusion layer being more than about 5.0 microns and
15 less than 25.0 microns.

4. A fuel cell, comprising: ~

an anode support plate and a cathode support plate and a membrane electrode assembly disposed between said anode and cathode support plates, said membrane electrode assembly
5 comprising a polymer electrolyte membrane, at least one of said support plates comprising a hydrophilic substrate layer having pores therein;

a water transport plate adjacent to each said hydrophilic substrate layer, each said water transport plate having a passageway
10 for a water stream and another passageway for a reactant gas stream;

a diffusion layer disposed between at least one said hydrophilic substrate layer and said membrane electrode assembly; and

15 means for creating pressure differential between said reactant gas streams and said coolant stream such that the pressure of each said reactant gas stream is greater than the pressure of said coolant stream, said pressure differential being more than 0.2 psi and less than 1.7 psi.

5. A fuel cell, comprising:

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an anode support plate and a cathode support plate and a membrane electrode assembly disposed between said anode and cathode support plates, said membrane electrode assembly
5 comprising a polymer electrolyte membrane, at least one of said support plates comprising a hydrophilic substrate layer having pores therein;

a water transport plate adjacent to each said hydrophilic substrate layer, each said water transport plate having a passageway
10 for a water stream and another passageway for a reactant gas stream; and

means for creating pressure differential between said reactant gas streams and said coolant stream such that the pressure of each said reactant gas stream is greater than the pressure of said coolant
15 stream, said pressure differential being more than 0.2 psi and less than 1.7 psi.